

TED05 – (Part E9) Further Ozone for HL

Name _____

1. E.9.1 **Explain** the dependence of O₂ and O₃ dissociation on the wavelength of light. (3) $\lambda = 242 \text{ nm}$ $\text{O}_2 \rightarrow 2\text{O}\bullet$, $\lambda = 330 \text{ nm}$ $\text{O}_3 \rightarrow \text{O}_2 + \text{O}\bullet$. *The energy needed should be related to the bonding in O₂ and O₃.*
 - a. Provide the speed of light equation:
 - b. How do λ and f have inverse relationships? (A few diagrams may help)
 - c. The energy of a wave is directly associate to the f of a wave. What equation can help to explain this?
 - d. It takes more energy to break apart O₂ than O₃, explain (being sure to mention the resonance of O₃) :
2. E.9.2 **Describe** the mechanism in the catalysis of O₃ depletion by CFCs and NO_x. (2) *For example: $\text{CCl}_2\text{F}_2 \rightarrow \text{CClF}_2 + \text{Cl}\bullet$, $\text{Cl}\bullet + \text{O}_3 \rightarrow \text{ClO}\bullet + \text{O}_2$, $\text{ClO}\bullet + \text{O}\bullet \rightarrow \text{O}_2 + \text{Cl}\bullet$. AND $\text{NO} + \text{O}_3 \rightarrow \text{NO}_2 + \text{O}_2$, $\text{NO}_2 + \text{O}\bullet \rightarrow \text{NO} + \text{O}_2$. The net effect is: $\text{O}_3 + \text{O}\bullet \rightarrow 2\text{O}_2$.*
 - a. As discussed with the SL material, ozone can be depleted by the presence of CFC's in the upper atmosphere by producing highly reactive chlorine radicals. Provide a series of equations to show the depletion of ozone from CFC's.
 - b. The Chlorine radical is eventually stopped from depleting more ozone when it becomes 'locked-up' in 'sink' compounds. Provide several instances in which chlorine containing compounds can become "stable." You will see these referred to later in the lecture (E9.3).

- c. A series of reactions also allow nitrogen containing compounds to deplete ozone, provide these reactions:
3. E.9.3 **Outline** the reasons for greater ozone depletion in polar regions. (2) *Consider the seasonal variation in temperature in the upper atmosphere. Refer to surface catalysis on ice particles.*
- a. How is it that most CFC's are produced in temperate regions but the majority of ozone damage is confined to the polar regions?
- b. It has been reported that ozone depletion occurs fastest in spring months due to the polar vortex. Explain (using a diagram and explanation) what the polar vortex is:
- c. What are the polar stratospheric clouds? What chlorine containing compound do they build up?
- d. At the poles, what happens in the **winter/spring** months? What chlorine containing compound is favored?
- e. At the poles, what happens in the **summer** months? What chlorine containing compound is favored?